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SCIENCE :

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JOHN MICHELS, Editor.

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Residents of New York city who visited Cincinnati on the occasion of the meeting of the American Association for the Advancement of Science, doubtless returned with a better appreciation of the water supply of their own city.

Cincinnati draws its supply of water direct from the Ohio river, at a point within the city limits, and within a few yards of the outlet of a main sewer which discharges its abominations into the already discolored and muddy waters of the river.

Some idea may be formed of the condition of this water, when we state, that a small quantity poured into a washing basin, obscured the view of the bottom of the utensil, so opaque is the water by reason of its muddy impurity. And yet, the river at this time was at its best, for, undisturbed by rains or floods, it flowed past the city reduced to its lowest limits, and in its highest condition of purity.

Unanimity among the population of a large city on any one point, is not to be expected, but, it was with some surprise we heard expressions of admiration regarding this water, from some Cincinnatians. The majority of the people, however, were disgusted with the water supply of the city, and many were seeking their own remedy by the construction of artesian wells. The public press of Cincinnati, during our visit was loud in its denunciations of the evil, making excellent suggestions for obtaining the water supply from a purer source, and other needed improvements.

Recently the question has been much discussed, as to whether a city should draw its supply from a river, or from lakes and storage reservoirs. Which will give the best results?

This question is beset with many difficulties, and, in our opinion, cannot be determined in such a manner, that any particular decision for future guidance, *in all*

cases, can be delivered. We apprehend that local causes and conditions which vary for every locality, having due weight and being well considered, should decide the question.

Of course absolute purity is not demanded, neither is it essential. The object to be aimed at, and that must be secured at any cost, is such a condition of purity which may be expressed by the term "fitness."

A water that is free from any impurities dangerous to health, of a good color and inodorous, may be considered "fit" for the supply of a city.

The question as to the best source for a supply of water, has of late received much attention from chemists and sanitary engineers. Reviewing the discussions, we express the opinion, that water drawn from a river which is free from sewage contaminations and not subject to discoloration, is preferable to water collected in lakes and storage reservoirs. The storage of water in reservoirs for long periods, without doubt, causes a deterioration in the quality of the water, generating a variety of animal and vegetable forms that are characteristic of stagnant waters, and which are dangerous to health. River water, on the contrary, if not contaminated directly near the source of supply, is usually free from those impurities which are most undesirable.

On this point we refer our readers to "SCIENCE," Vol. I. page 67, where will be found an analysis of the water supply of Newark, N. J., obtained from the river Passaic, contrasted with water used in that city, obtained from driven wells. The result showed that the water from the Passaic river, although contaminated with sewage to a certain extent, and below what may be considered a satisfactory condition, stood at the head of the list in regard to purity and general fitness for sanitary purposes. We believe that recently Professor Leeds, of Hoboken, has made analyses of the same waters, with very similar results.

But, from whatever source water may be obtained, a certain amount of manipulation appears to be essential before it is fit for distribution in a city. In the first place it should be held in a reservoir for 24 hours, to permit the suspended matter to subside; it should go through some simple process of filtration; and, lastly, be pumped to a sufficient elevation to secure a supply of water to the upper part of every house in the city.

The question of the public filtration of water for city use no doubt presents many difficulties, but until such filtration is accomplished by the authorities, every householder should make use of a filter, to cleanse from impurities, the water used for drinking and cooking purposes; for apart from the question of health, the interest of the public in securing pure water is

not confined to its use as an article of diet, because for all purposes for which water is employed, the purer it is, the better it is adapted for use.

THE CONNECTION OF THE BIOLOGICAL SCIENCES WITH MEDICINE.*

By T. H. HUXLEY, LL.D.

"The great man whose name is inseparably connected with the foundation of medicine, Hippocrates certainly knew very little—indeed, practically nothing—of anatomy or physiology; and he would probably have been perplexed even to imagine the possibility of a connection between the zoological studies of his contemporary, Democritus, and medicine. Nevertheless, in so far as he and those who worked before and after him in the same spirit ascertained, as matters of experience, that a wound or a luxation, or a fever, presented such and such symptoms, and that the return of the patient to health was facilitated by such and such measures, they established laws of Nature and began the construction of the science of pathology. All true science begins with empiricism, though all true science is such exactly in so far as it strives to pass out of the empirical stage into that of the deduction of empirical from more general truths. Thus, it is not wonderful that the early physicians had little or nothing to do with the development of biological science; and, on the other hand, that the early biologists did not much concern themselves with medicine. There is nothing to show that the Asclepiads took any prominent share in the work of founding anatomy, physiology, zoology and botany. Rather do these seem to have sprung from the early philosophers, who were essentially natural philosophers, animated by the characteristically Greek thirst for knowledge as such. Pythagoras, Alcmaeon, Democritus, Diogenes of Apollonia, are all credited with anatomical and physiological investigation; and though Aristotle is said to have belonged to an Asclepiad family, and not improbably owed his taste for anatomical and zoological inquiries to the teachings of his father, the physician Nicomachus, the 'Historia Animalium,' and the treatise 'De Partibus Animalium,' are as free from any allusion to medicine as if they had issued from a modern biological laboratory.

"It may be added, that it is not easy to see in what way it could have benefited a physician of Alexander's time to know all that Aristotle knew on these subjects. His human anatomy was too rough to avail much in diagnosis, his physiology was too erroneous to supply data for pathological reasoning. But when the Alexandrian school, with Erasistratus and Herophilus at their head, turned to account the opportunities of studying human structure afforded to them by the Ptolemies, the value of the large amount of accurate knowledge thus obtained to the surgeon for his operations, and to the physician for his diagnosis of internal disorders, became obvious, and a connection was established between anatomy and medicine, which has ever become closer and closer. Since the revival of learning, surgery, medical diagnosis, and anatomy have gone hand in hand. Morgagni called his great work 'De Sedibus et Causis Morborum per Anatomen Indagatis,' and not only showed the way to search out the localities and the causes of disease by anatomy, but himself travelled wonderfully far upon the road. Bichat, discriminating the grosser constituents of the organs and parts of the body one from another, pointed out the direction which modern research must take; until at length histology, a science of yesterday, as it seems to many of us, has carried the work of Morgagni as far as the microscope can take us, and has extended the realm of pathological anatomy to the limits of the invisible world.

"Thanks to the intimate alliance of morphology with medicine, the natural history of disease has, at the present day, attained a high degree of perfection. Accurate regional anatomy has rendered practicable the exploration of the most hidden parts of the organism, and the determination during life of morbid changes in them; anatomical and histological post-mortem investigations have supplied physicians with a clear basis upon which to rest the classification of diseases, and with unerring tests of the accuracy or inaccuracy of their diagnosis. If men could be satisfied with pure knowledge, the extreme precision with which, in these days, a sufferer may be told what is happening, and what is likely to happen, even in the most recondite parts of his bodily frame, should be as satisfactory to the patient as it is to the scientific pathologists who gives him the information. But I am afraid it is not; and even the practising physician, while nowise underestimating the regulative value of accurate diagnosis, must often lament that so much of his knowledge rather prevents him from doing wrong than helps him to do right. A scornful of physic once said that Nature and disease may be compared to two men fighting, the doctor to a blind man with a club, who strikes into the *mêlée* sometimes hitting the disease and sometimes hitting all Nature. The matter is not mended if you suppose the blind man's hearing to be so acute that he can register every stage of the struggle and pretty clearly predict how it will end. He had better not meddle at all until his eyes are opened—until he can see the exact position of the antagonists, and make sure of the effects of his blows. But that which it behooves the physician to see, not indeed with his bodily eye, but with clear intellectual vision, is a process, and the chain of causation involved in that process. Disease, as we have seen, is a perturbation of the normal activities of a living body; and it is and must remain unintelligible so long as we are ignorant of the nature of these normal activities. In other words, there could be no real science of pathology until the science of physiology had reached a degree of perfection unattained, and indeed unattainable, until quite recent times.

"So far as medicine is concerned, I am not sure that physiology, such as it was down to the time of Harvey, might as well not have existed. Nay, it is, perhaps, no exaggeration to say that, within the memory of living men, justly renowned practitioners of medicine and surgery knew less physiology than is now to be learned from the most elementary text book, and, beyond a few broad facts, regarded what they did know as of extremely little practical importance. Nor am I disposed to blame them for this conclusion; physiology must be useless, or worse than useless, to pathology, so long as its fundamental conceptions are erroneous. Harvey is often said to be the founder of modern physiology, and there can be no question that the elucidations of the function of the heart, of the nature of the pulse, and of the course of the blood, put forth in the ever-memorable little essay, 'De motu cordis,' directly worked a revolution in men's views of the nature and of the concatenation of some of the most important physiological processes among the higher animals, while indirectly their influence was perhaps even more remarkable. But, though Harvey made this signal and perennially important contribution to the physiology of the moderns, his general conception of vital processes was essentially identical with that of the ancients; and in the 'Exercitationes de generatione,' and notably in the singular chapter, 'De calido innato,' he shows himself a true son of Galen and of Aristotle. For Harvey, the blood possesses powers superior to those of the elements; it is the seat of a soul which is not only vegetative, but also sensitive and motor. The blood maintains and fashions all parts of the body, *idque summâ cum providentiâ et intellectu, in finem certum agens, quasi ratiocinio quodam uteretur*. Here is the doctrine of the *pneuma*, the product of the philosophical mould into which the animism of primitive men ran in Greece, in

* International Medical Congress London, 1881.